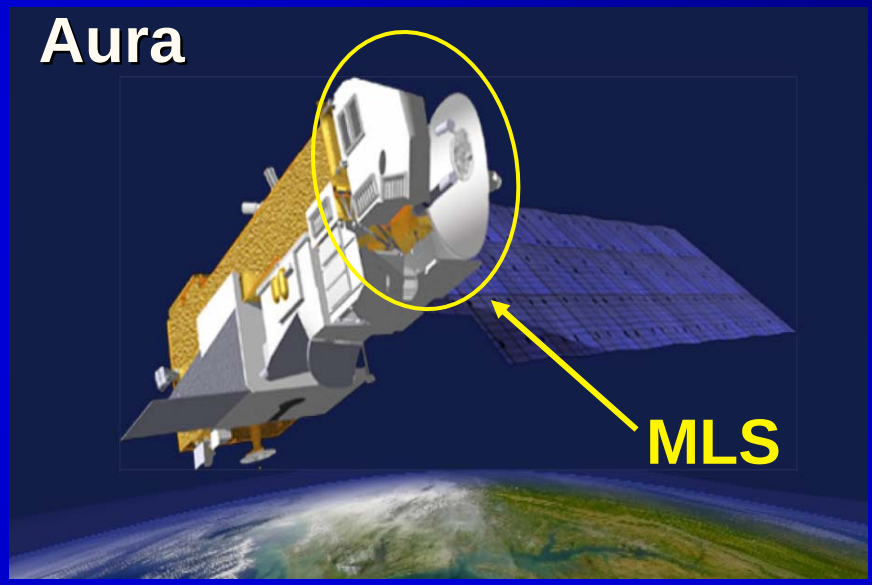

The Microwave Limb Sounder (MLS) on Aura

presentation at 8 July 2004 Aura pre-launch meeting

Joe Waters
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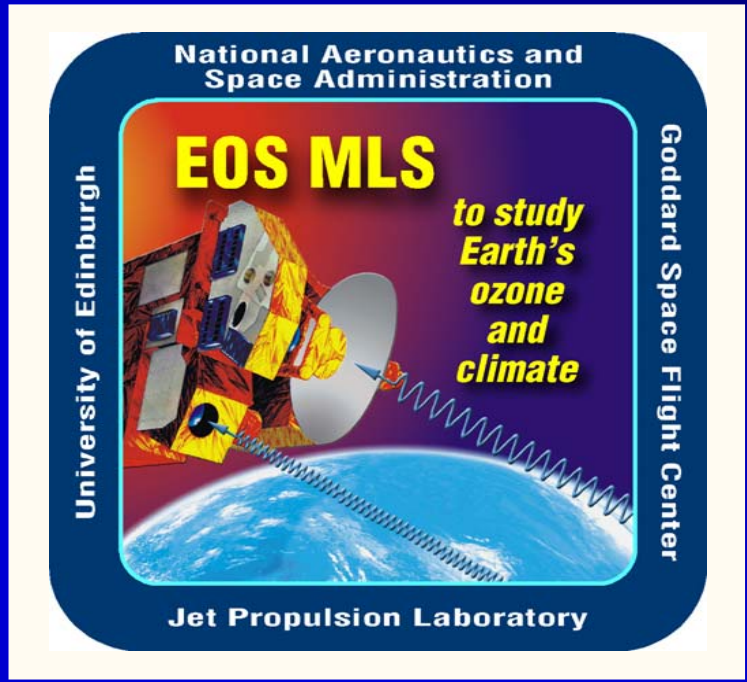
Microwave Limb Sounder (MLS)

- **Overall Science Objectives**
  - Track recovery of the ozone layer
  - Understand aspects of how composition affects climate
  - Quantify aspects of pollution in the upper troposphere



- **Lucien Froidevaux will cover MLS Science in following talk**

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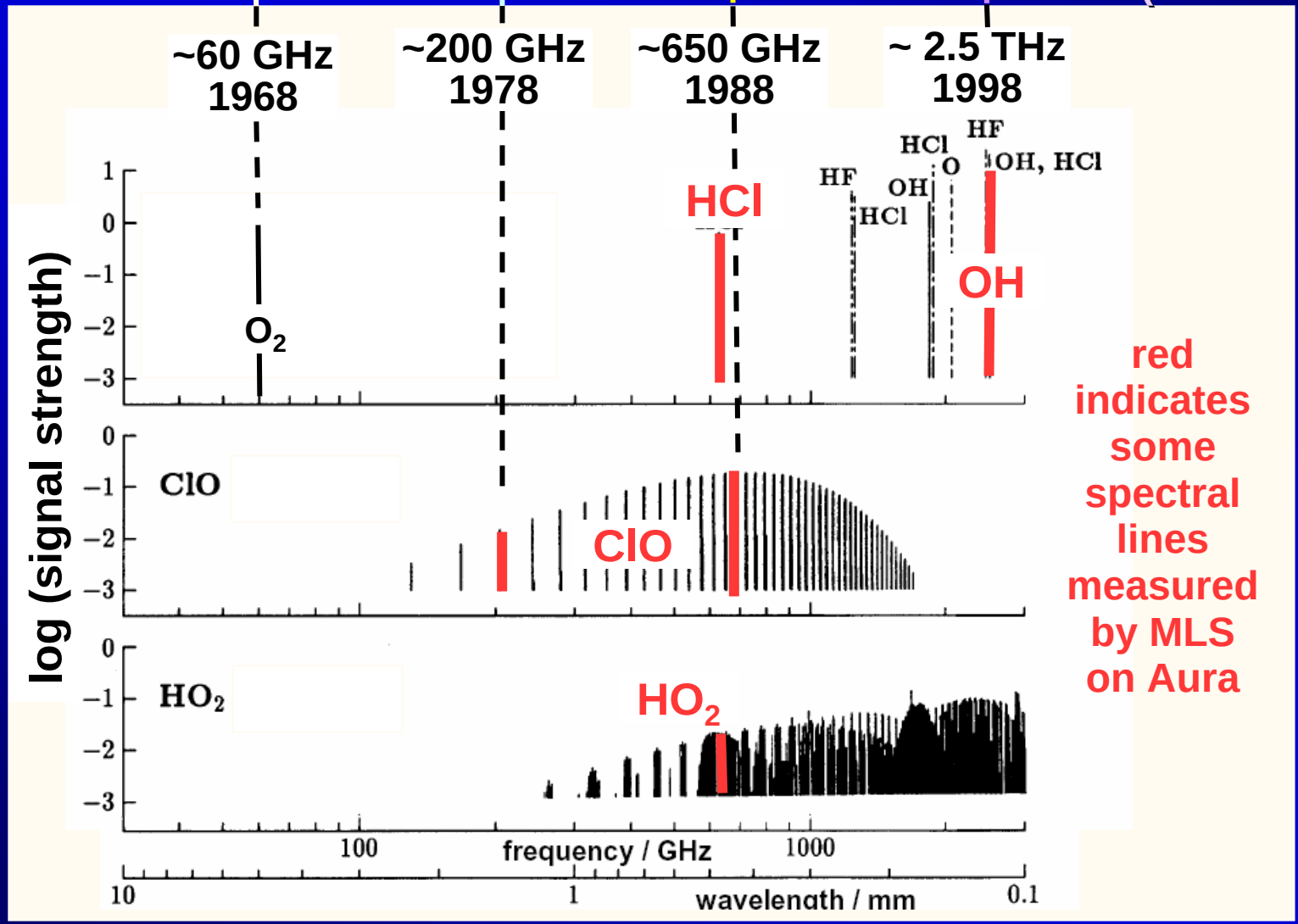
Millimeter / Submm Technology & Spectra

~ 1968 technology limit (Nimbus-5 μWave Spectrometer)

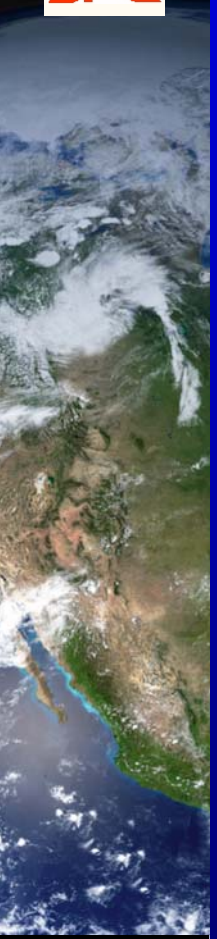
~ 1978 limit (UARS MLS)

~1988 limit (EOS MLS proposal)

~1998 (EOS MLS)



red indicates some spectral lines measured by MLS on Aura



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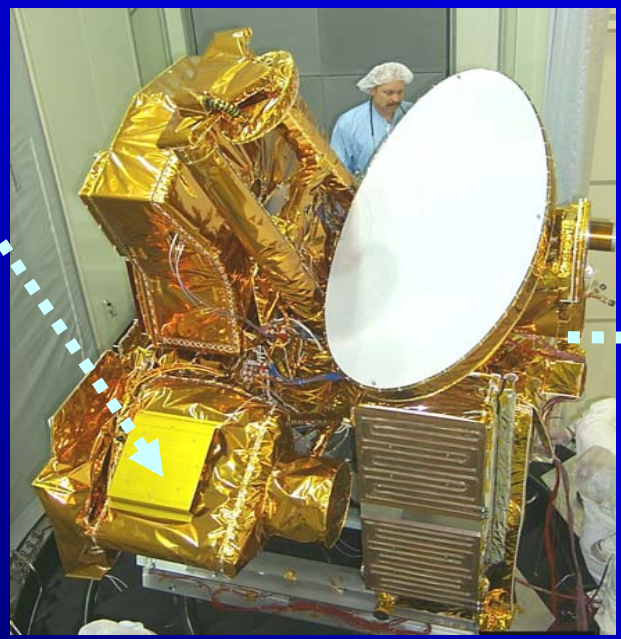
EOS MLS Instrument

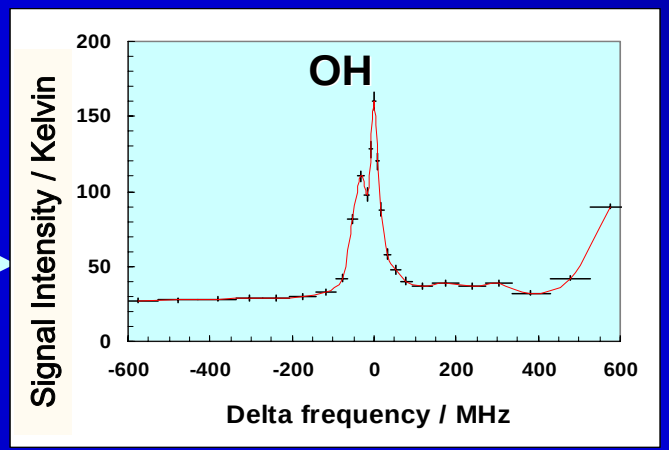
- **Advanced follow-on to UARS MLS launched in 1991**
  - radiometers in 5 broad bands between 118 GHz, 2.5 THz
  - 455 kg, 535 W , 100 kb/s data, 28 spectrometers
- **Pioneers satellite measurements over full submm-wavelength region (0.1 - 3 mm)**
  - enabled by new technology
- **All requirements met**

New technology

JPL's planar submillimeter diode developed for MLS OH measurement



Flight instrument



Example of expected signal
(from balloon precursor instrument)

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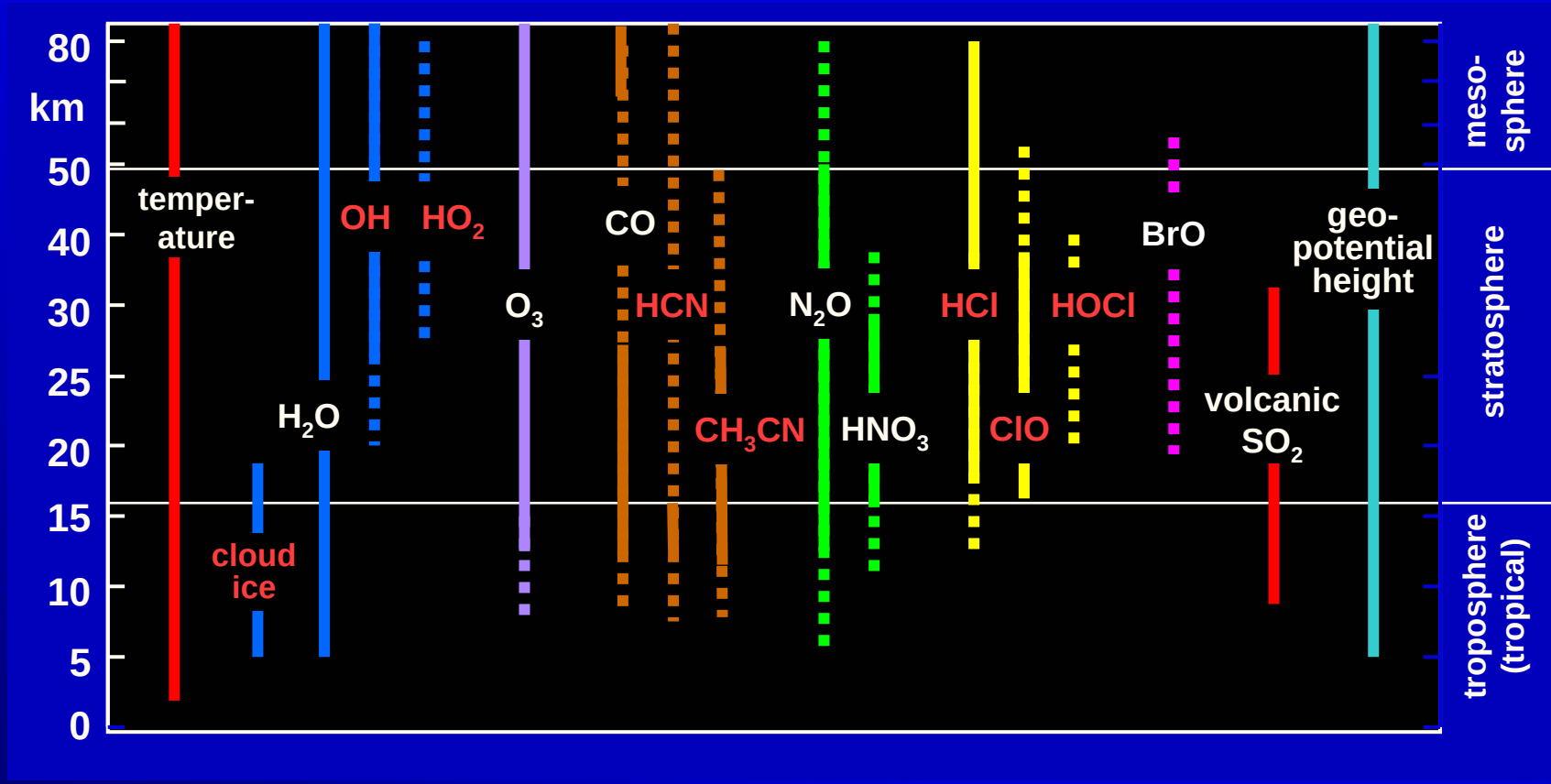
EOS MLS Measurements

Solid lines indicate useful individual profile measurements are generally obtained.
Dashed lines indicate that averages are generally needed for useful precision.
Red font indicates Aura measurements made only by MLS.



- All measurements made simultaneously and continuously, day and night, including in presence of cirrus and dense volcanic aerosol
- Limb scan, calibration, and vertical profile each 1.5° (165 km, 25 s) along suborbital track. 82°S to 82°N latitude coverage on each orbit

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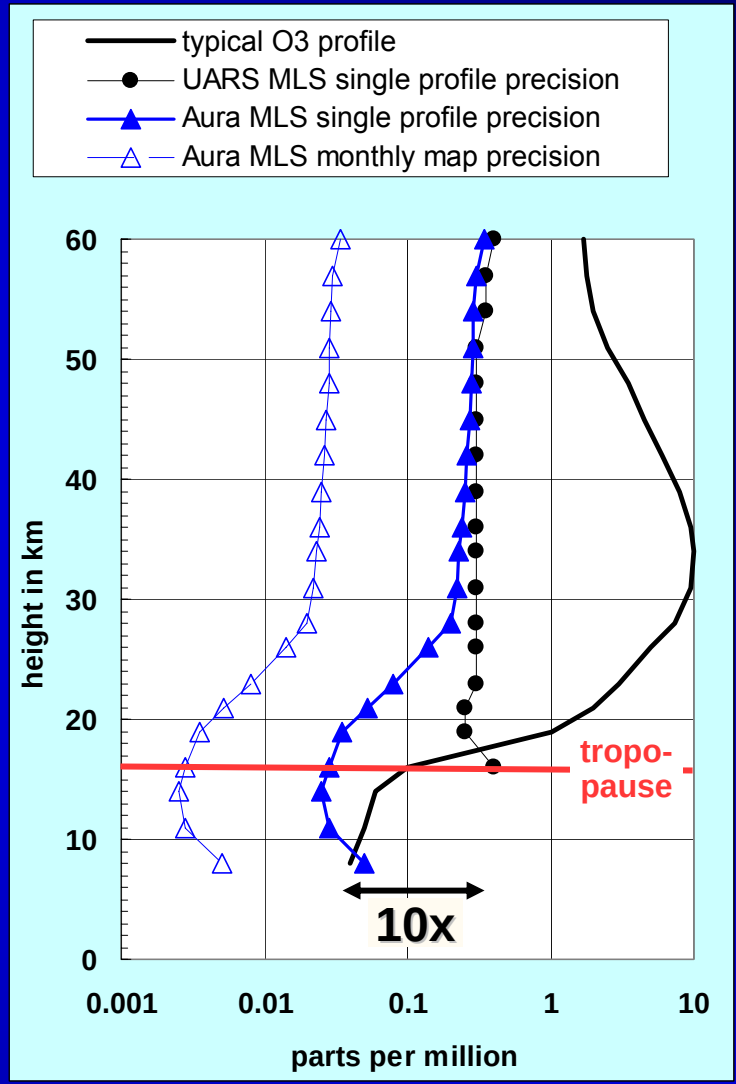
Comparison of UARS and Aura MLS Ozone Measurement Capability

- **UARS MLS**
  - profile measured each ~500 km along orbit
  - no tropospheric O_3 measurements
- **Aura MLS**
  - profile measured each 165 km along orbit, ~3x denser than UARS MLS
  - measures upper trop O_3, as well as stratosphere and mesosphere O_3
  - lower stratospheric O_3 sensitivity ~10x better than UARS MLS



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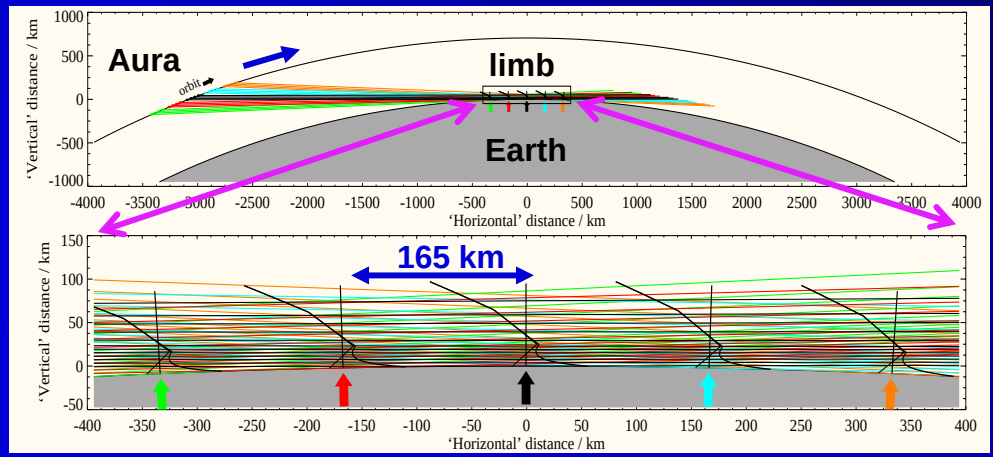
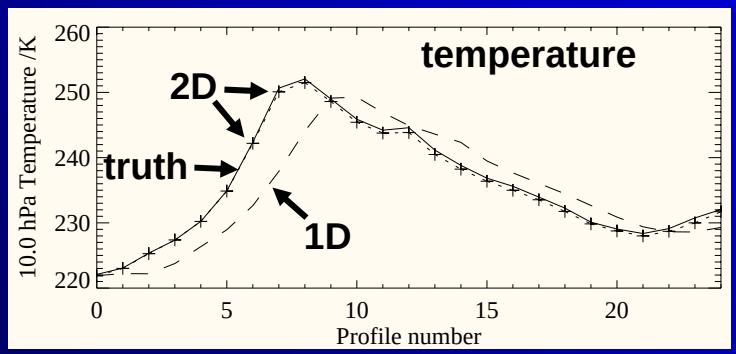
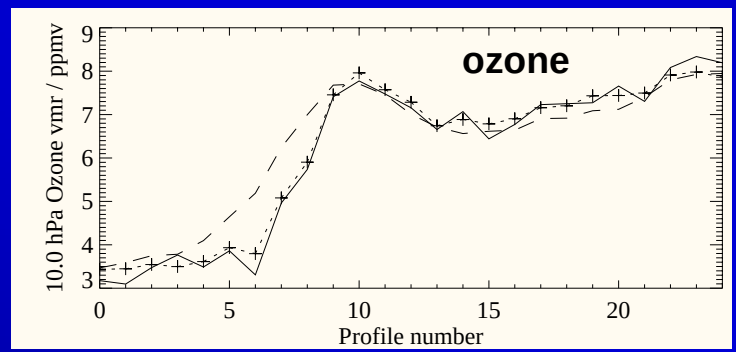
MLS 2D Retrieval Algorithm

- **MLS observing geometry allows direct 2D retrieval of both vertical and line-of-sight atmospheric structure**
  - 'horizontal-ish' lines show some selected MLS line-of-sights
  - up arrows show locations of retrieved profiles



- **2D retrieval algorithms developed & used for EOS MLS**
  - developed by Nathaniel Livesey and Bill Read [*GRL*, 2000]
- **Improvements over 1D algorithms shown below**
  - solid line is 'truth', crosses are 2D retrievals, dashed line is 1D





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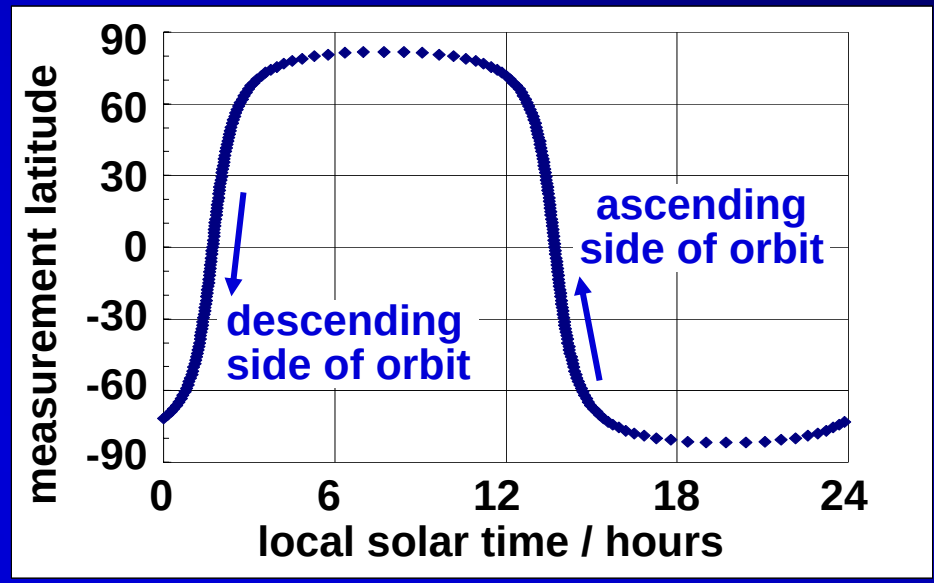
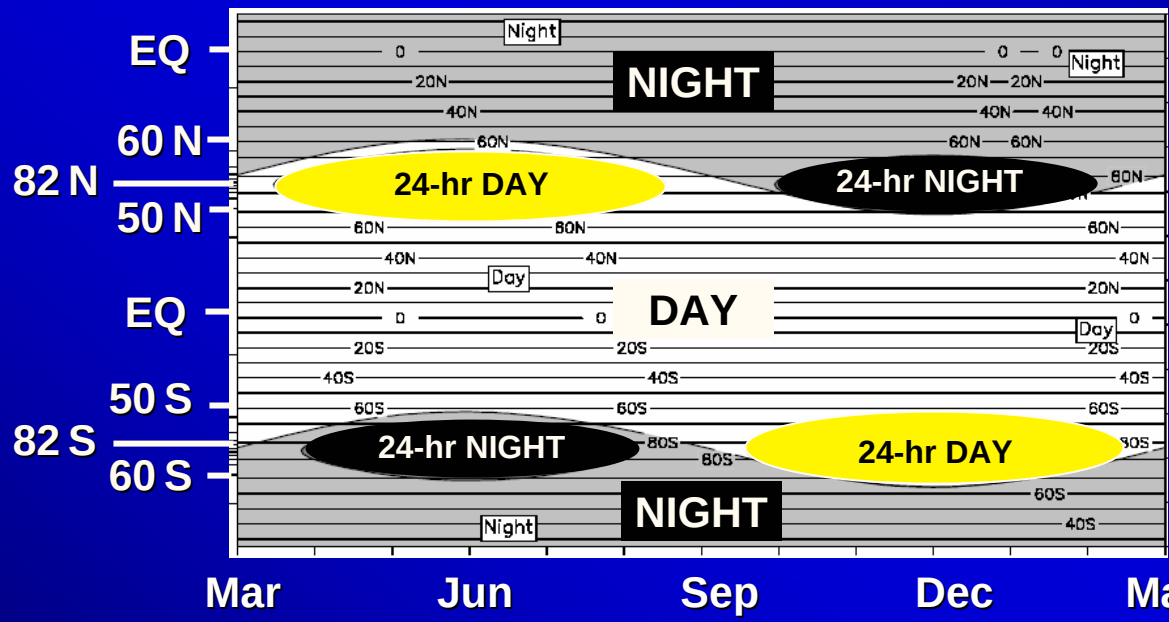
Local time, day/night for MLS measurements

measure-ment local time versus latitude

(each point on plot at right gives latitude and local time of each MLS profile around an orbit)



annual cycle of day-night boundary of measure-ments



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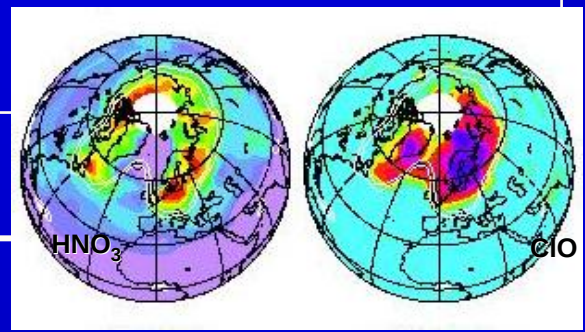
MLS Major Activities through Launch + 1.5 year ('success-oriented')

Launch +3 days	start instrument activation
Launch +10 days	instrument activation complete, start characterization
Launch +17 days	start initial processing to Level 2 on SCF
Launch +32 days	begin nominal instrument operations, processing to Levels 1 and 2 on SIPS
Launch +60 days	start delivering preliminary data to GSFC DAAC
Launch + ~6 mo	start delivering preliminary validated data to GSFC DAAC
Launch + ~1.5 yr	start delivering validated data to GSFC DAAC



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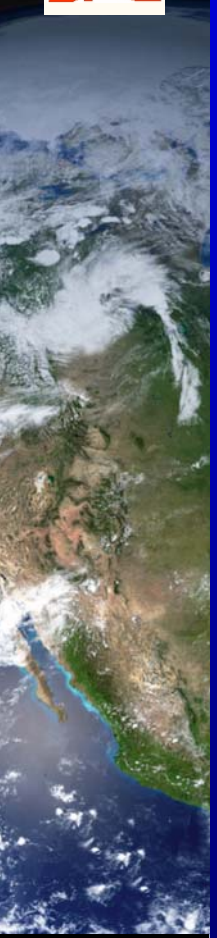
MLS 'Core' Science Team

name	*org*	*data product responsibility*
Joe Waters	JPL	MLS Principal Investigator
Bob Harwood	U of E	UK MLS Principal Investigator
Lucien Froidevaux	JPL	Stratospheric O_3, HCl, HOCl data
Robert Jarnot	JPL	GHz Level 1 radiance data
Rick Cofield	JPL	Geopotential height data
Mark Filipiak	U of E	CO and upper tropospheric O_3 data
Jonathan Jiang	JPL	Cloud ice data
Yibo Jiang	JPL	Level 3 data
Nathaniel Livesey	JPL	N_2O, BrO, CH_3CN data
Gloria Manney	JPL	Dynamical consistency of data
Herb Pickett	JPL	THz Level 1 radiance data; OH & HO_2 data
Hugh Pumphrey	U of E	HCN and stratospheric H_2O data
Bill Read	JPL	Upper trop H_2O & SO_2 data
Michelle Santee	JPL	ClO and HNO_3 data
Michael Schwartz	JPL	Temperature data
Dong Wu	JPL	Cloud ice data



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